

# PATENT ABSTRACTS OF JAPAN

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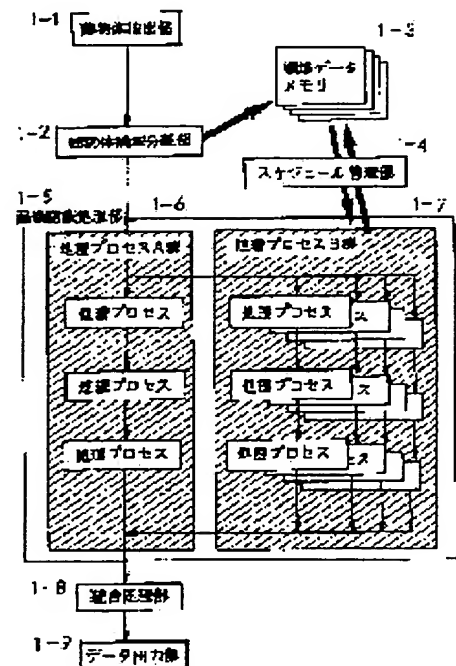
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## (54) MOVING OBJECT RECOGNITION PROCESSING METHOD USING MULTIPROCESS

### (57)Abstract:

PURPOSE: To enable a processing at a real time by extracting a moving object by processing an input image, detecting the attribute of the object, labelling it and measuring the number of moving objects by attributes.

CONSTITUTION: At a moving object extraction part 1-1, a moving object area in the image is calculated by successively inputting moving images containing moving objects. Next, at a moving object area separation part 1-2, the moving object area is segmented as a single image at every linked area in the extracted moving object group and stored in an area data memory 1-3. Further, an image recognition processing part 1-5 performs attribute judgement and counting to the extracted area image separated to be an object allocated by a schedule managing part 1-4 corresponding to processing process for judging two or more attributes. Thus, the moving object image can be recognized at a high speed and high level concerning the moving image provided from a TV camera or the like.



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## CLAIMS

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[Claim(s)]

[Claim 1] The animal object extract process in which an animal object field is extracted from an input image, and the animal object field separation process which carries out sequential separation of this extract field, and is accumulated in field data memory with the separated time of day, In the image recognition processing process which consists of at least two or more treatment processes which detect the attribute of the separated animal object, and said attribute detection The schedule management process in which advance of said treatment process is managed in the direction in which the number of attribute judgments per unit time amount increases, The animal object recognition art using the multi-process characterized by having the integrated processing process which unifies the result of said treatment process for every unit time amount, and carries out labeling to counting or this animal object for every attribute of an animal object.

[Claim 2] An input image is an animal object recognition art using the multi-process according to claim 1 which is an image between slit space-time and is characterized by performing an extract by taking and making difference with a background image binary in an animal object extract process.

[Claim 3] An input image is an animal object recognition art using the multi-process according to claim 1 which is an image between slit space-time and is characterized by performing an extract by performing a correlation operation with a background image in an animal object extract process, and performing threshold processing.

[Claim 4] Two or more processes of using for an image-recognition processing process are the animal object recognition arts using the multi-process according to claim 1 characterized by to consist of a treatment process A group which performs directly easy attribute judging processing to the extract field separated according to the animal object field separation process, and a treatment process B group which performs comparatively complicated attribute judging processing to the image once accumulated in field data memory.

[Claim 5] A treatment process B group is an animal object recognition art using the multi-process according to claim 4 characterized by performing processing to an animal object field in the order which constituted in juxtaposition two or more image recognition treatment processes which perform the same processing, and was assigned by the schedule management process.

[Claim 6] A treatment process B group is an animal object recognition art using the multi-process according to claim 4 characterized by performing processing which constitutes the image recognition treatment process which performs different processing in or more at least one juxtaposition, and has a processing demand

according to a schedule management process in the order arranged for every processing kind.

[Claim 7] The need for prediction or processing be judge for the throughput of an attribute judging for every separated extract field , and a process be specify as it , and a processing image and a recognition result be re-accumulate after predetermined processing progress , and a schedule management process be an animal object recognition art using the multi-process according to claim 1 characterize by dissociate , or accumulate with recognition data respectively , without re-dissociate re-about a field image .

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[Translation done.]

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] Using the image processing by the multi-process, this invention recognizes the attribute of a migration body (for example, people, a car, the body on a conveyor belt), and relates to the animal object recognition art which performs labeling or processing which carries out counting according to this attribute.

[0002]

[Description of the Prior Art] An animal object is extracted out of a time series image, and the attempt which carries out statistics processing of the data according to the attribute of the extracted animal object is advanced. It is carrying out counting according to a passerby's attribute from the image which specifically photoed the passerby who walks along a foot walk etc. Here, attributes are that he is human being, sex, age, a dress, a dress color, passing speed, the migration direction, etc.

[0003] In such counting, on-line processing is desirable. the attribute exception which analyzed the dynamic image obtained with frame spacing extent, and has unified and recognized data to be on-line processing here for every unit time amount for several seconds thru/or about 10 minutes -- counting -- it is obtaining a result. that is, -- although an input image is the real time (dozens of times per second) -- counting -- a result means processing made into several seconds - every 10 minutes according to the use purpose.

[0004] If counting of the passerby can be carried out according to an attribute in such on-line processing, various use, such as visitor measurement in traffic measurement in a shopping center, a store, and the event hall, can be considered.

[0005]

[Problem(s) to be Solved by the Invention] When it aims at the above use, the trouble of a Prior art is as follows.

(1) the algorithm which extracts and carries out counting of the animal object according to an input image -- various \*\*\*\* -- the attribute of an animal object -- subdividing -- counting -- the algorithm which processes a result statistically is not realized.

(2) The single configuration of a process is common. That is, an animal object is extracted from an input image and the method of processing by single-loop processing until it carries out counting of this is taken. In this case, the complexity of the attribute judging processing of an animal object in which a system is possible will be decided with the most complicated input image. That is, when it is going to process the input image of all situations in the real time, it is necessary to decide by the design stage what kind of attribute judging is performed for the most complicated image.

[0006] a complicated situation which people's herd will pass if a passerby's counting is taken for an example -- taking into consideration -- counting -- when it is going to operate a system normally, it is difficult to judge and carry out counting of a passerby's fine attribute in respect of the processing time, and is only carrying out counting of the passerby according to a direction at most.

(3) If complicated processing is performed in an input image with an eye on improvement in counting accuracy etc., in order to exceed 33msec(s) in many cases, real-time requirement is lost.

(4) Although the attempt which takes in a multi-process to an image processing is starting recently, there is almost no example which recognizes the attribute of a migration body finely and carries out statistics processing for every unit time amount. Furthermore, there is also no example using DS required for this or an integrated processing algorithm.

[0007] As mentioned above, conventionally effective technique is not proposed to attribute recognition processing of the migration body in the online which this invention makes an aim. This invention aims at making processing possible in the real time.

[0008]

[Means for Solving the Problem] this invention -- set -- (1) input image -- the real time -- incorporate -- and counting -- (3) to which the animal object which extract an animal object so that a leak may not arise, and which carried out (2) extracts detect an attribute in a detail as much as possible -- for every unit time amount for several seconds -- about 10 minutes, counting of the migration body be carry out according to an attribute, or an attribute identifier (label) be give to a migration body (on-line) -- it be make like.

[0009]

[Function] And this invention processes an input image, extracts an animal object, detects the attribute of this body, and it carries out labeling to this body, and it measures the number of animal objects according to this attribute.

[0010] Specifically an animal object field image is separated and accumulated with separation time of day for every connection field, real-time processing of each connection field group which is the schedule which considers the throughput and the need for processing as decision description, and was accumulated is carried out by the image recognition treatment process constituted by multistage and juxtaposition, and image recognition processing of the variety of each field is performed. every [ furthermore, ] field -- integration of all recognition results -- carrying out -- after unit time amount progress -- an attribute exception -- counting -- a result is outputted.

[0011]

[Example] When this invention is summarized in advance of explanation, it is a thing like a degree. separating an animal object field, accumulating in memory with separation time of day in claim 1, and processing this in two or more processes -- image incorporation, attribute recognition, and counting of the real time -- since processing is independently controllable, it can respond to change of an input image flexibly. That is, counting according to attribute is made, holding real-time requirement also to a complicated image.

[0012] claim 2 -- setting -- not a two-dimensional image but a slit image -- using -- moreover, difference -- it is performing binary-ization and high-speed processing is attained. In claim 3, it is effective in improvement in the robustness in the lighting fluctuation in the case of an extract by using a correlation operation. That is, even

when the brightness of the background which exists in a processing-object image shifts compared with a reference background image by change of a sunshine condition etc., it becomes possible to extract an animal object field correctly.

[0013] In claim 4, even when time is taken very much for example, in attribute judging processing and a process is overdue by dividing a configuration process into two groups according to the processing purpose, an easy attribute judging is surely performed and counting of low precision can be performed.

[0014] In claim 5, a schedule can be set up so that a processing load may be distributed and each process may always process, and it becomes possible to perform an attribute judging at a high speed.

[0015] In claim 6, required sufficient processing can be performed to the target animal object field, and more nearly high-speed processing also becomes possible by parallelization of the same treatment process further.

[0016] In claim 7, useless processing cannot be performed to an object domain and multiple processes can be used efficiently. Furthermore, according to a case, more detailed recognition processing is attained by re-division of an animal object field.

[0017] The technique of performing hereafter the extract of the highly precise counting and the dress color attribute of a person image which walk on a foot walk as one example of this invention is explained with reference to the block diagram of drawing 1. In addition, it is easy an object to apply to another migration body instead of a person, and it is easy to be made to extract other attributes. Also by the signal of the distance data based on a supersonic wave, infrared radiation, etc., a sample signal is possible, and should just read and replace brightness with a distance value.

Hereafter, it explains as an example of the TV camera input under the light.

[0018] First, in the animal object extract section 1-1, the dynamic image containing a migration body is inputted serially, and it asks for the animal object field in an image. That is, the image information on one line equivalent to measurement Rhine samples, a 1-dimensional slit image obtains from the image which photoed the person who passes through measurement Rhine on the foot walk which is a background by the fixed angle type, and after extract the part which is changing to a background image and performing the noise component removal by the plastic-surgery processing on Rhine, and separation of a shadow field if needed, a slit-like change field image and a corresponding real image accumulate.

[0019] However, not only a TV camera but a 1-dimensional sensor may be used for acquisition of a 1-dimensional slit image, and a background image performs renewal of a background using the input image to current if needed using a slit image or the background image fixed beforehand when the time of there not being an initial frame or a pedestrian is chosen at its own discretion and a user takes out a command with the time of initiation of operation.

[0020] Here, an animal object extract according to claim 2 calculates the absolute value of the difference of an input image to a background image, and is realized by binary-ization-extracting the part which is changing and making a binary-ized slit image.

[0021] Moreover, an animal object extract according to claim 3 performs the correlation operation of a background image and an input image to each pixel on a slit, and it calculates, similarity, i.e., a correlation value, with a background image. Furthermore, it realizes by making the binary-ized slit image which judges the pixel which carries out threshold processing of the correlation value of each pixel, and is changing, and includes an animal object field.

[0022] Next, in the animal object field separation section 1-2, it starts as a single image for every connection field of animal \*\*\*\* extracted by the animal object extract section 1-1, and accumulates in the field data memory 1-3. That is, labeling of the change field image obtained in order in the real time is serially carried out to a target, and a series of connection field images used as the same label are formed.

Furthermore, the connection field image is used for a mask, superposition and a two-dimensional animal object field image are made for the information on a real slit image, and both are accumulated in the field data memory 1-3 for every field.

[0023] Moreover, characteristic quantity, such as 0, the 1 or secondary moment, and a minimax value of a field coordinate, is calculated about each connection field image to coincidence, and it accumulates in the field data memory 1-3 with the separation time of day. Here, in the field data memory 1-3, a connection field image and an animal object field image, the separated time of day, characteristic quantity, and a recognition result are accumulated for every field. Data are outputted and inputted with directions of the schedule Management Department 1-4 to the image recognition processing section.

[0024] At the schedule Management Department 1-4, it manages so that processing with the number of attribute judgments sufficient and required per unit time amount may have an attribute judging treatment process to the animal object field data serially generate by the target by the above-mentioned processing advance.

[0025] Here, at the schedule Management Department according to claim 7, the array and assignment of the optimal field to each attribute judging process are performed, and each accumulated connection field is inputted into each process of the image recognition processing section so that the need for prediction of the throughput which changes with contents of processing, and various processings is judged for every connection field, a processing load is distributed, each process may always process and only required processing may be performed. Furthermore, the processing image and recognition result after each process termination are re-accumulated. Moreover, a field image is re-separated if needed and it accumulates with recognition data respectively.

[0026] Next, in the image recognition processing section 1-5, the treatment process which performs at least two or more attribute judgments performs attribute judging and counting to the separated extract field image used as the object assigned by the schedule Management Department 1-4.

[0027] Here, the image recognition processing section according to claim 4 consists of a treatment process A group 1-6 which performs directly easy attribute judging processing, and a treatment process B group 1-7 which performs comparatively complicated attribute judging processing to the image once accumulated in the field data memory 1-3.

[0028] ,s such as field division using brightness information as a treatment process, field division using color information, matching with profile information and the model image in a pedestrian's image between space-time, and person head detection by the person model, can be considered.

[0029] Distinguishing a noise field and the field equivalent to solo passage by the treatment process A group 1-6 based on characteristic quantity, such as 0, the 1 or secondary moment, and a minimax value of a field coordinate, about each connection field accumulated in the field data memory 1-3 counting — the passing direction is judged by calculating the number on the basis of a solo passerby's datum-level product value from the area value more than a threshold, and calculating the grade of a field if



needed.

[0030] A treatment process B group according to claim 5 constitutes in juxtaposition two or more image recognition treatment processes which perform the same processing, and performs processing to an animal object field in the order assigned by the schedule Management Department 1-4.

[0031] For example, like drawing 2, an animal object field is extracted in order at each time of day (A, B, C, D, E), and presupposes that the throughput of each field to a certain attribute processing a is predicted (suppose that the same is said of the throughput to other attributes). In addition, the alphabetic character of the left end in the oblong rectangle shown in drawing 2 thru/or drawing 6 expresses a field label, and the rectangular die length corresponds to throughput. What is necessary is just to take a processing schedule like drawing 3, in order to process each field so that a processing load may be distributed and the number of attribute judgments per unit time amount may increase when the processes a (for example, counting by field area processing, field division processing using color information, etc.) which perform the same processing like drawing 3 are constituted in three-piece juxtaposition at this time. Moreover, what is necessary is just to advance processing to the same processing schedule like drawing 4, even if it regards it as one treatment process X combining each attribute judging processing to a serial in order to perform a more complicated attribute judging.

[0032] Moreover, a treatment process B group according to claim 6 constitutes the image recognition treatment process which performs different processing in plurality [ every ] juxtaposition, and performs processing which has a processing demand by the schedule Management Department in the order arranged for every processing kind.

[0033] For example, what is necessary is to constitute in juxtaposition the processes a, b, c, and d (for example, the field division processing using brightness information, field division processing using color information, person head detection by the person model, etc.) which perform different attribute extract processing like drawing 5, to arrange to a treatment process and just to advance processing in the extract situation of an animal object field like drawing 2, when judged with there being the need for processing by the schedule Management Department about each field. Moreover, what is necessary is to combine each attribute judging processing with juxtaposition, and just to assign a field group with the need for processing to a process like drawing 6, in the direction whose number of attribute judgments per unit time amount increases in the corresponding field group, in order to perform a more nearly high-speed attribute judging.

[0034] furthermore, counting which performs each attribute judging and counting in the integrated processing section 1-8 using two or more sorts of processing results obtained by random from the image recognition processing section 1-5 about each connection field, unifies after unit time-amount progress (after that -- every unit time amount), and can be set by the present time of day -- a result is outputted and corrected and it outputs to the data-output section 1-9. for example, counting [ in / advanced counting is performed from the field division result using color information and head detection result of an object domain, and / a treatment process A group ] -- a result is corrected. Moreover, statistics processing of the color field in a field is performed from a field division result, and a person's dress color attribute is judged.

[0035] the last -- the data output section 1-9 -- the attribute judging and counting by the present time of day -- a processing result is outputted.

[0036]

[Effect of the Invention] With the conventional technique, since processing was advanced in the single process in order and the processing result was serially outputted to the motion area which processes a dynamic image for every unit time amount, and is obtained, the object domain of processing could be complicated, or in order to make more advanced recognition processing perform, when the complicated image processing was performed, processing took time amount, and the real-time requirement of processing was not able to be maintained.

[0037] According to this invention, there is an advantage that the advanced migration body image which is a high speed can be recognized from the dynamic image obtained from images, such as a TV camera.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] It is a block diagram explaining the animal object recognition approach.

[Drawing 2] It is drawing explaining the throughput predicted to be the extract situation of a certain animal object field.

[Drawing 3] It is drawing explaining parallel form processing of the same treatment process.

[Drawing 4] It is drawing explaining the parallel form processing by the treatment process considered as the serial configuration of a uniprocessing process.

[Drawing 5] It is drawing explaining parallel form processing of a different-species treatment process.

[Drawing 6] It is drawing explaining the processing made into two or more parallel forms of a different-species treatment process.

### [Description of Notations]

1-1 Animal Object Extract Section

1-2 Animal Object Field Separation Section

1-3 Field Data Memory

1-4 Schedule Management Department

1-5 Image Recognition Processing Section

1-6 Treatment Process A Group

1-7 Treatment Process B Group

1-8 Integrated Processing Section

1-9 Data Output Section

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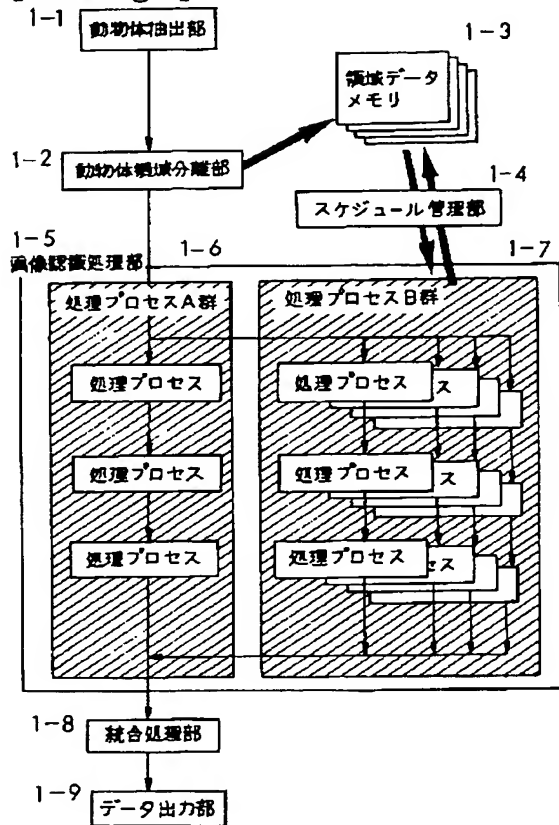
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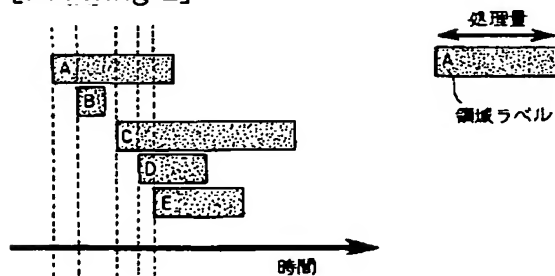
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## DRAWINGS

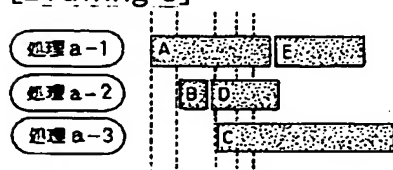
[Drawing 1]



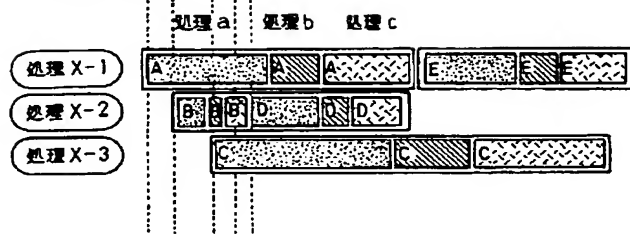
[Drawing 2]



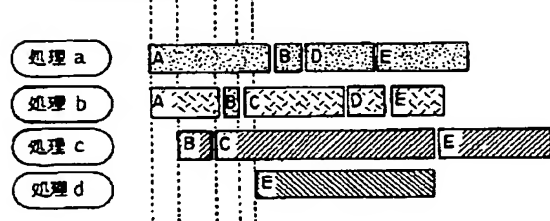
[Drawing 3]



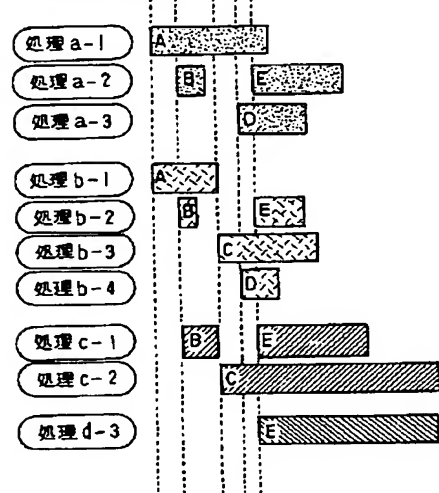
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]